I. Aims and Objectives

- Creation of an affective student model to infer and reason about learners’ emotions.
- Select pedagogical, motivational and affective actions that maximise students’ learning, understanding and motivation.
- Design, implement and test PlayPhysics, an emotional games learning environment for teaching Physics at undergraduate level.

II. Affective Educational Games and Intelligent Tutoring

- Game-based learning environments actively involve students and enable them to learn through experiencing the effects of their actions (Squire, 2003).
- Educational games are multi-sensorial environments where mastery and skill are rewarded.
- Affective gaming focuses on influencing and identifying the player’s emotional state.
- An Intelligent Tutoring System (ITS) is incorporated into a game-based learning environment to achieve effective assessment criteria.

III. Affective Student Modelling

- Presently, there is no system that can recognise accurately all the learner’s emotions.
- We focus on building an affective student model from cognitive and motivational variables using observable behaviour.
- Dynamic Bayesian Networks (DBNs) were derived (e.g. Figure 1) using a Probabilistic Relational Models (PRMs) approach based on the ‘Control-Value Theory of Achievement Emotions’ (Pekrun et al., 2007).

IV. PlayPhysics Design and Implementation

- PlayPhysics includes a space adventure scenario (Figure 2) where learners must solve diverse challenges by applying their knowledge of Physics.

V. Tutor Model and Multimodal Output Modulation

- Dynamic Decision Networks (DDNs) are incorporated into Olympia (Figure 3) to select the pedagogical or motivational action that maximises understanding of the structure underlying Physics, e.g. hints, questions, micro-explanations.
- Visuals and sounds create a sense of immersion, indicate changes in narrative, set a mood and decrease the learning curve (Collins, 2008; Lester & Stone, 1997).
- Colours will reflect the learner’s emotion or an emotion that aims to counteract the learner’s negative state (Kaya, 2004).

VI. Preliminary Evaluation of the Affective Student Model

- A pre-test and a questionnaire, comprising PlayPhysics’ topics and game dialogue, were applied to 28 students at Tecnológico de Monterrey, Mexico City.
- The evidence obtained through the two questionnaires was propagated in the outcome-prospective emotions DBN.
- Results obtained through comparing the inferred emotion by PlayPhysics’ affective student model with the students’ reported emotion, showed an accuracy of 60.71% (Figure 4).

VII. Conclusion and Future Work

- PlayPhysics reasons about learners’ emotions using the Control-Value Theory of Achievement Emotions.
- Results show promise when evaluating the prospective-outcome emotions DBN.
- Further tests will be conducted with a larger population of students and with the other DBNs on completion of implementation of the first challenge.

VII. Publications